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Strategic Decision Making at Commercial Building Fires

Les Stephens

Garland Fire Department, Garland, Texas

CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed: _____

Abstract

Despite having a Standard Operating Procedure (SOP) for Commercial and industrial building fires, company officers and Incident Commanders (IC) within the Garland Fire Department (GFD) were given no specific definitive criteria for making strategic decisions at such incidents. This action research paper examines the critical factors used by command officers of other career departments within the State of Texas, recognized fire service leaders, and chief officers of the Garland Fire Department when making strategic decisions at these types of incidents. It further examines the guidelines for, or absence thereof, of specific criteria used when making strategic decisions at such incidents. The original research shows both a lack of, and a desire for, such information in a useable format. Procedures used included research questions, a literature review and an on-line questionnaire. The results were the discovery of limited existing and consistent information across all three groups. The recommendations were to develop a list of specific criteria to guide strategic decision making at commercial fire incidents. Once completed, the list could be incorporated into the existing SOP and subsequent training could be conducted on the new SOP and recognition of these critical factors by GFD personnel.

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Strategic Decision Making at Commercial Building Fires

There is no decision that is made at a working structure fire more basic, nor advanced, than “offensive” or “defensive.” No other decisions can or need be made before the incident commander determines the strategy that he will employ. One might think the decision to “go” or “not go” would be a simple and straight-forward one, but nothing could be further from the truth. No other decision made during the course of an incident places firefighters in a position of immediate danger or calculated safety more so than the decision of “offensive” or “defensive.” Nowhere else is the potential for immediate catastrophic failure and subsequent multiple injuries or deaths more present than at a commercial building fire. For the purpose of this research, “commercial building” will encompass all occupancies that cannot be classified as either single or multi-family residential.

With such dire consequences riding on these decisions, one might assume there would be no shortage of literature, training materials or training programs that address what definitive criteria incident commanders should evaluate when making strategic decisions. Unfortunately, this is not the case. Even fire service literature, authored by some of the most respected leaders in the industry, stop short of specifically identifying critical factors that should indicate, with any degree of certainty, the call for an offensive or defensive strategy.

Contrast this absence, or shortage, of information with the emergency medical protocols that guide our decision making process when confronted with situations of full arrest. The University of Texas Southwest Protocols for Therapy (Pepe, 2007) very clearly defines the criteria that paramedics should look for when determining whether or not to initiate cardio pulmonary resuscitation on people found in full arrest. Dependent lividity, rigor mortis, decomposition, decapitation, incineration, head or chest injury visibly incompatible with life or

the presence of do not resuscitate orders are all acceptable reasons to not initiate life saving measures on another human being. A list of definitive reasons for which paramedics can “write off” a life exists, however a similar list of reasons firefighters can use to “write off” a structure has yet to be developed.

Despite increased awareness and training there has been no significant decrease in the number of Line of Duty Deaths (LODD) at commercial building fires in the United States in the last 20 years. The problem is that the GFD does not have criteria for establishing a defensive strategy at commercial building fires. GFD SOP #206: Procedures for Commercial and Industrial Buildings, does not specify any specific criteria that line officers or ICs should use when determining whether to employ an offensive or defensive strategy. In fact, the SOP even specifies the procedures to be used when an offensive attack is initiated on a heavily involved commercial or industrial building (Appendix A). Without a policy or guideline, company officers and battalion chiefs, as well as others in similar positions throughout the country, are left to make split second decisions with unparalleled consequences. If the fire service’s goal of reducing the number of LODD of firefighters in the United States (U.S.) is ever to be realized, significant changes must be made.

The purpose of this applied research project is to develop criteria for GFD officers to use when making strategic decisions at commercial building fires. The criteria can subsequently be incorporated into an SOP for strategic decision making at commercial building fires. Action research will be used to answer the following questions: What criteria do other industries use to make strategic decisions in situations where life safety is a concern? What, if any, standard criteria exists within the U.S. Fire Service for making strategic decisions at commercial building fires? What, if any, criteria is used by other career departments within the State of Texas to make

strategic decisions at commercial building fires? What criteria do recognized Fire Service leaders believe should be considered when making strategic decisions at commercial building fires?

Background and Significance

Numerous incidents over the last twenty years suggest the need for the establishment of definitive criterion for strategic decision making at commercial building fires. On July 1, 1988, five firefighters were killed at Hackensack Ford in Hackensack, New Jersey. The men died when the bowstring-truss roof of an auto dealership they were working in collapsed on them (Klem, 1988). An accidental fire claimed the lives of six Worcester, Massachusetts firefighters on December 3, 1999. The men became disoriented while operating in a vacant six-story cold-storage warehouse (National Institute for Occupational Safety and Health, Six career fire fighters killed in cold-storage and warehouse building fire - Massachusetts (99F-47), 2000). An early morning fire in a McDonald's restaurant claimed the lives of two Houston, Texas firefighters on February 14, 2000. They, too, were killed when the roof of the restaurant they were working in collapsed on them (National Institute for Occupational Safety and Health, Restaurant fire claims the life of two career fire fighters - Texas (F2000-13), 2001). On June 18, 2007, nine Charleston, South Carolina firefighters died while fighting a fire in the Sofa Super Store. The men were operating inside the building when the steel-bar joist roof suddenly collapsed on them (Charleston, 2007).

In each of the above referenced incidents, the first arriving company officer or the IC chose to initiate an offensive strategy. Unfortunately, in each of these instances the decision to change to a defensive strategy never came or came too late to save these firefighters' lives. These incidents are only a snap-shot of what has been an on-going trend in the U.S. Fire Service over the past twenty-plus years. The trend is to commit firefighters to an offensive strategy at

commercial building fires with little to no guidelines or training on how to recognize and interpret critical factors that would dictate the need for a change in strategy. Change must occur early enough to allow for safe and orderly withdrawal to defensive positions prior to the catastrophic failure of the building.

Numerous books, reports and statistics point to a need for change in our response to commercial building fires. According to the National Fire Protection Association (NFPA) report on Firefighter Fatalities 2007 (Fahy, LeBlanc, & Molis, 2008), there were 102 firefighters killed in the line of duty. Even though more deaths occur at residential fires than at any other type of occupancy, commercial buildings continue to pose the greatest risk. Despite the considerably lower number of responses to commercial buildings, 6.4 firefighter deaths occurred at these types of buildings for each 100,000 responses, compared to only 3.7 deaths for each 100,000 responses to residential fires (Fahy, LeBlanc, & Molis, 2008). The report goes on to say that the highest death rates over the five year period from 2002 to 2006 occurred in stores and offices. In his book, *Managing Major Fires*, Coleman (2001) points out that even though the majority of fires that firefighters respond to occur in single-family residences, the number of casualties are higher at vacant commercial occupancies (Coleman J. , 2001).

Heightened awareness, increased training requirements and active efforts by fire service leaders to reduce the annual number of LODDs of firefighters in the United States (U.S.) has failed to provide a consistent appreciable decrease over the last 30 years. According to NFPA statistics the number of LODDs (excluding the deaths at the World Trade Center in 2001) has ranged from a high of 173 in 1978, to as low as 75 in 1992, but has consistently exceeded 100 over the 30 year time frame from 1977 to 2007 (Fahy, LeBlanc, & Molis, 2008). This fact is particularly disturbing considering there has been more than a 16% decrease in the number of

non-residential structure fires in the U.S. between 1999 and 2007 (National Fire Protection Association, 2007). An estimated 530,000 structure fires were reported to public fire departments in 2007, this represents a relatively steady decrease in structure fires from a high of 1,098,000 in 1977 (Kartner Jr., 2008).

Although the GFD has not experienced a LODD, critical evaluation of those situations that pose the greatest risk to GFD personnel and the steps to be taken to prevent such tragedies from occurring must evolve. Based on statistical information, aside from roadway incidents as well as responding to and returning from calls, commercial building fires pose one of the greatest threats to GFD personnel. Compounded by the fact that the GFD has experienced a great number of retirements in recent years, the GFD now has younger, less experienced, officers who must make these difficult decisions without the benefit of years of real world firefighting experience. This Applied Research Paper (ARP) will help insure that current and future GFD officers and incident commanders are better prepared to make strategic decisions at structure fires involving commercial buildings.

With a population of 217,963, the City of Garland is a 57 square mile suburb of Dallas, Texas (U.S. Census Bureau, 2000). The GFD, which responded to 20,398 calls in 2008, is comprised of 247 personnel providing service to the community out of 11 stations (Garland Fire Department, 2008 a). Even though each business is not necessarily housed in its own building, each business does represent the opportunity for a fire in a commercial structure, and in 2008, the department conducted 8,776 business inspections (Garland Fire Department, 2008 b).

In addition to being beneficial to other individuals and organizations concerned with the dangers posed by commercial building fires, as a cataloged ARP available through the National Fire Academy's (NFA) Learning Resource Center (LRC) this research will assist current and

future officers of the GFD to make more informed decisions when faced with marginal strategic situations at commercial building fires. The ARP will also address the U.S. Fire Administration (USFA) operational objective of “reducing the loss of life from fire of firefighters” (U.S. Fire Administration, 2008, pp. II-2).

The research correlates with information learned in Executive Development (R123), the first of four courses that make up the NFA’s Executive Fire Officer Program (EFOP). By completing this ARP and developing and implementing a corresponding SOP within the GFD, the researcher will have caused a great deal of disequilibrium within the organization that will lead to the need for an adaptive change.

Literature Review

Many different theories reveal how fire officers make decisions on the fire ground. From basic situational awareness and risk versus benefit models to more complex studies of intellectual recall upon which Klein Association’s recognition prime decision making is based. Ideas and concepts are discussed at length in numerous other excellent works such as Marcus Lusk’s *Assessing Decision Making Processes in Dynamic, High-Risk Environments to Enhance Safety for Amarillo Fire Department Personnel* (Lusk, 2008). How the decisions are made is not the focus of this research, rather, the objective of the literature review that follows is to examine those critical factors that prompt, or should prompt, fire officers and incident commanders to make the decision to select one strategy over another.

The American Heritage Dictionary defines strategy as “the overall planning and conduct of large-scale military operations” or “a plan of action” (American Heritage Dictionary, 1989). The Firefighter’s Handbook, 3rd ed., defines strategic goals as “the overall plan developed and used to control an incident” (Main, 2008, p. 1117). Basic fire ground strategies can be divided

into offense and defensive. The *National Fire Protection Handbook*, 19th ed. (2003) calls the offensive-defensive decision “the most critical factor in the risk-benefit analysis” (Cote, Fire protection handbook, 19th ed. vol 1, 2003, pp. 7-335). As this literature review will attempt to convey, for something so crucial, the lack of information on the subject is nothing short of disturbing.

“Offensive operations are conducted inside the hazard area,” (Brunacini, 2002, p.220). An offensive strategy occurs when firefighters advance attack lines inside a building to attack a fire at its base. The method hopes to place the firefighters in close enough proximity to the seat of the fire to direct the extinguishing agent, most commonly water, directly on the burning material. The justification, or advantage, of an offensive strategy provides hope to contain the fire to as small an area as possible while at the same time minimizing the damage. As a down side to the strategy, firefighters must enter the structure and are thus subject to not only the products of combustion but also being trapped by a catastrophic collapse of the building itself (McIsaac, Rogers, & Stoppa, 2008). “Defensive operations stay outside of the hazard area,” (Brunacini, 2002, p. 220). In contrast, a defensive strategy is most often employed at incidents where it is believed that the fire has escalated beyond the control of an offensive attack or “where the level of risk to firefighters conducting an interior attack would be unacceptable” (McIsaac, Rogers, & Stoppa, 2008, p. 624). A defensive strategy calls for the use of master streams and large diameter hand lines to direct water on, or into the building, via natural or manmade openings in the structure, while at the same time keeping firefighters in exterior positions which are deemed relatively safe (McIsaac, Rogers, & Stoppa, 2008).

What factors should influence a fire ground officer’s perception of the level of risk is the focus of the balance of this researcher’s literature review. Despite the presence of many books,

videos and classes on strategic decision making, there has yet to be a list of agreed upon criteria developed that would help company officers or incident commanders take into account the situation in front of them and arrive at a common and consistent level of risk for the same or similar incident. What critical factors should be considered when choosing one strategy over another?

In conducting the literature review, the researcher found that many books and resources that one might believe would contain pertinent information for this topic, in fact, did not. One such example is *Strategic and Tactical Considerations on the Fireground*, (Smith, 2002). Despite being an excellent resource and text for fire officers, and containing a section titled *Large Commercial Buildings and Warehouses* (Smith, 2002, p. 297), the author limits his discussion of this topic to information that, while informative and beneficial, does not clearly specify factors a fireground officer should consider when selecting one strategy over another. A second example is *Firefighting Strategies and Tactics* (Angle, Gala, Harlow, Lombardo, & Maciuba, 2001) which is a useful tool for firefighters, yet it too stops short of specifying critical building characteristics, fire flow issues, occupancy types or other factors that would lead an officer to order a defensive operation over an offensive one. In fact, in the *Commercial Building Scenario* case study, it specifies that an “offensive fire attack will be the initial mode of operation,” (Angle, et al., 2001, p.504). The International Fire Service Training Association’s (IFSTA) *Fire Department Company Officer*, 3rd ed., discusses offensive and defensive modes, however similar to the previous two references, it does not address any specific reasons the officer may use to choose one strategy over the other (Goodson & Sneed, 2001).

Other excellent fire service resources examined that did not contain detailed information germane to this topic were: *Incident Command System* (Carlson, 1983), *Incident Management for*

the Street Smart Fire Officer (Coleman J. , 1997) and *Fundamentals of Fire Fighter Skills* (McIsaac, Rogers, & Stoppa, 2008). One other point that must be made here is that none of the books cited in this paragraph, or the preceding one, contain a definition of the word “strategy” in their glossary. These are not the only resources that the researcher had hoped would contain information that did not, but the literature review illustrates the lack of information on this subject.

In addition to those resources cited above, there were texts and articles that did contain limited information, which while not exactly what the researcher was hoping for, should be discussed here. One such example is *Fire Command 2nd ed.* by Chief Alan Brunacini. According to Brunacini, our basis for, what he refers to as, “operational incident strategy management” has evolved from military terminology that has been adapted for use in the fire service (Brunacini, *Fire command*, 2nd ed., 2002, p. 217). He refers to numerous factors that the Incident Commander (IC) should consider when selecting whether the correct operational mode will be an offensive or defensive strategy. In a section titled *Identifying the Strategic Mode*, Brunacini (2002), lists what he refers to as “an array of standard critical incident factors and their related characteristics,” which include, “the fires extent and location, any savable occupants, fire effect, savable property, entry and tenability, ventilation profile, special hazards, local violence, terrorism and resources,” (Brunacini, 2002, p. 222). These appear to be first vestiges of what should hopefully evolve into a list of critical factors, or if interpreted correctly, definitive criteria for incident commanders to use when making strategic decisions.

Older texts, such as *Firefighting Strategy and Tactics*, (Carter, 1998), indicated that the IC’s offensive versus defensive decision should be based on answers to the following questions: “how much fire department attack force do I have, how much fire must these forces attack, and

are there lives endangered that can be safely rescued?” (Carter, 1998, p. 12). Cater goes on to explain that “where there is more fire than attack force, the choice would probably be defensive in nature.” He does not, however, specify how the IC should make that determination.

“One of the most courageous decisions an Incident Commander (IC) can make is to pull their crews out of a burning building and go defensive,” (Jakubowski, 2008, p. 40). In his article, *Get Out*, Chief Jakubowski (2008) takes on this difficult and controversial subject by pointing out that firefighters consider pulling out of, or being ordered out of, a burning building as “downright cowardly,” (Jakubowski, 2008, p. 40). Specifying four main categories of conditions, he believes the IC should monitor the following during an incident: building construction, equipment conditions, staffing issues and fireground conditions. He believes that the IC should continually monitor the building for safety problems such as structural degradation or evidence of impending collapse. He also addresses smoke and interpreting changes, or lack thereof, as evidence that crews are not making any progress on the fire. Other items related to building conditions considered critical are means of ingress and egress, lack of progress by the ventilation crew, and fire spreading unchecked over the heads of interior crews. Apparatus malfunctions, insufficient staffing, or a lack of progress by initial attack crews are also justification for changing to a defensive strategy according to Jakubowski (2008). The last and most obvious factor is that “the incident may simply be too large for handlines and interior firefighting,” (Jakubowski, 2008, p. 42).

Chief Brunacini expands on some of the factors he addressed in *Fire Command* (2002) in an article titled *Timeless Tactical Truths*, (Brunacini, 2008). Accurately estimating the amount of time the fire has been burning and using that assessment as a gauge for deciding what is already lost versus what is still savable is of critical importance to the IC (Brunacini A. , 2008). The

accuracy of this assessment will depend on the officer's experience and training. Those same two characteristics, experience and training, will be crucial in evaluating what progress, if any, is being made. According to Brunacini, evaluating the effect of the actions being taken should be self-evident "it does not take long to know if what we are doing is working" (Brunacini, 2008, p. 208) and if we determine it is not, it is up to the IC to either direct more resources to reinforce our current positions or make the decision to change to a different plan altogether.

Another author who attempts to address some of the critical factors is the Fire Department of New York's, John Norman. According to Norman (1998), fire loads are typically higher in commercial buildings which drive a need for increased fire flows to combat fires within these types of structures. The increased fire load is usually the result of materials stored within the building rather than the materials from which the building is constructed. Another point that Chief Norman makes, which must be considered a critical decision factor, is that it can require in excess of 800 or 900 gallons per minute (gpm) of water to knock down a large fire in a store (Norman, 1998, p. 353). One of the most important factors addressed by Norman, and one that was largely to blame for most of the deaths referenced in the Background and Significance portion of this ARP, are lightweight truss-roof systems and plywood I-beams. He compares making an offensive attack on a well developed fire in a building where these types of construction are present to "playing Russian roulette with three bullets in the cylinder," (Norman, 1998, p. 343).

To expand on or explain Chief Norman's assertion that it can take nearly 1000 gpm of water to extinguish a well developed fire in a commercial building, one must examine the way fire flows are calculated. According to the Fire Chief's Handbook, (Bachtler & Brennan, 1995), the National Fire Academy's formula for determining the Required Fire Flow is:

$$\text{Required Flow in gpm} = \frac{L \times W \times \text{Number of Floors Involved}}{3}$$

Where: GPM = Gallons per minute,

Where: L = Length,

And W = Width of the structure in feet.

The Required Fire Flow is for a fully involved structure. If only a portion of the structure is involved, the amount should be reduced accordingly. Typically, this reduction is calculated by estimating the percent of the structure involved such as 10%, 25%, or 50% (Bachtler & Brennan, 1995). The 19th ed. of NFPA's *Fire Protection Handbook* indicates that "the essential question to be answered is how many gpm are required to extinguish a given fire with properly placed hose lines" (Cote, Fire protection handbook, 19th ed. vol 1, 2003, pp. 7-337). The required fire flow calculation is considered so important, in this case, because it must be known in order to determine how many firefighters will be required to operate the necessary number and size of hose lines to achieve the required flow (Cote, Fire protection handbook, 19th ed. vol 1, 2003).

Application of this formula to two different, well known businesses illustrates the point that, indeed, needed Fire Flow should be considered a critical factor for strategic decision making. Take for example a McDonald's restaurant that measures 70 feet wide x 120 feet long (Appendix B). Required Fire Flow = $\frac{70' \times 120'}{3}$ or 2800 gpm for 100% involvement, 1400 gpm for 50% involvement and 700 gpm for 25% involvement, and 280 gpm for just 10% involvement. A second example to consider would be Walmart (Appendix C). The store measures 400 feet long x 620 feet wide. Required Fire Flow = $\frac{400 \times 620}{3}$ or 82,666 gpm for 100% involvement, 41,333 for 50% involvement, 20,666 for 25% involvement and 8266 gpm for only 10% involvement.

Literature Review Summary

The literature review reveals that while limited information does exist on critical factors for strategic decision making, in most cases it is general in nature. It certainly appears that the list is incomplete, limited at best, and that a concerted effort to expand on and compile the existing information into a standardized and useable document would be beneficial. The case could also be made, based on the limited amount of information that was found and information cited from *Get Out*, (Jakubowski, 2008) that there exists within the U.S. Fire Service a critically flawed culture that discourages, even the thought, of going defensive.

Procedures

Action research was chosen for this ARP because it afforded the researcher the opportunity to put forth a list of critical factors that, while certainly not the end-all to this discussion, will serve as a starting point for the development of a training program and SOP for strategic decision making at commercial buildings within the GFD. Beyond its initial value to the GFD, this ARP will offer others who chose to further examine this topic a starting point for similar discussions within their organizations as well as a reference for the continued research of this topic.

The research process for this paper was initiated in July 2008, while attending the Executive Development (R-123) course at the National Fire Academy in Emmitsburg, Maryland. The on-line card catalog at the LRC was used to identify relevant journals, publications, books and other ARPs that offered potentially relevant information on this subject. It was during this initial search for information that it was realized how scarce information might be on this subject. Despite the shortage of resources, the necessary reference information was collected and copies of numerous ARPs were solicited.

Numerous visits to the Fort Worth Public Library and hours spent with the head librarian confirmed that little information existed regarding critical factors for strategic decision making. Numerous sources on strategic decision making that offered help with personal decisions like whether or not to change a career buy a new car or invest one's money differently were identified. However, none dealing with military, law enforcement or fire service strategic decision making were located. Further efforts to locate literary materials led the researcher to the helpful staff of the Collin College Library. Collin College offers both law enforcement and fire science degrees as well as basic training academies for both careers. Unfortunately, they did not have any law enforcement or military literature either. References located within several fire service books and those that contained applicable information are cited herein. Additional measures to locate references for the literature review led the researcher to examine books that were used as sources on promotional exams within the GFD. Journals, periodicals and LODD reports as well as books contained in the GFD Training Division's library and the researcher's own literary collection, were most useful for the literature review.

All attempts to locate information that answered the first research question of what criteria other industries used to make strategic decisions where life safety is a concern, proved unsuccessful. Very few sources were identified, with most being law enforcement related, resulting in an absence of specified criteria related to this subject. Initially, this seemed peculiar, but after finding a similar lack of information on this topic related to the fire service, it was interpreted by the researcher to be simply another example of just how difficult it is, or would be, to set forth a specific list of critical factors to consider when making strategic decisions where life safety is a concern regardless of the field being studied.

The extensive literature review aimed to address the second research question of what, if any, standard criteria exists within the U.S. Fire Service for making strategic decisions at commercial building fires. Numerous books, journals, reports, periodicals and on-line sources were reviewed in an effort to identify whether or not a standardized list of these factors already existed. As shown in the literature review section, most resources have shied away from this topic, and of those who have offered information on the subject, many are not completely in agreement. Even though some of the sources shared common factors and criteria, the literature review reveals that there does not yet exist one document that sets forth agreed upon criteria for strategic decision making at commercial building fires within the U.S. Fire Service.

In order to answer the remaining two research questions of what, if any, criteria are used by other career departments within the State of Texas to make strategic decisions at commercial building fires and what criteria do recognized fire service leaders believe should be considered when making strategic decisions at commercial building fires, an external internet-based questionnaire was prepared (Appendix D) and responses solicited from three respondent groups. The same questionnaire was given to all three groups. The first group was chief officers from career departments within the state of Texas. This group was contacted by sending a link to the questionnaire to one representative from every career department who is a member of the Texas Fire Chief's Association (Gaston, 2008). The second group included chief officers within the GFD, and the third group involved recognized fire service leaders.

On October 18, 2008, a link to the questionnaire was e-mailed, along with a basic explanation of the focus of my research (Appendix E), to each individual recipient in all three groups. In addition to the link, contact information and solicitation for additional information encouraged the respondents to reply with any additional information which might be useful in

my research. The only information received, other than responses to the questionnaires, provided a couple of e-mails that applauded my efforts and explained the difficulties one might encounter trying to put forth such a list of critical factors. Then, on November 2, 2008, approximately two weeks after the initial e-mails, a follow-up e-mail to the same three groups of recipients expressed appreciation to those who had responded and notified those who had not responded that the questionnaire would expire on November 10, 2008. After the deadline, an on-line report generated the data in both PDF (Appendices F, G and H) and Excel formats (not included) for use in compiling the results section of this ARP.

There were fewer responses to the questionnaire than I anticipated. However, the responses received were very insightful and thought provoking. For the chief officers of career departments within the State of Texas, 100 e-mails sent resulted in a received total of 85 responses to the questionnaire (85%). For the group of chief officers within the GFD, the questionnaire addressed all ten chief level officers within the GFD and received seven responses (70%). For the recognized fire service leaders, the questionnaire petitioned ten individuals (Bobby Halton, Rick Lasky, Alan Brunacini, John Norman, Eddie Buchannan, John Salka, John “Skip” Coleman, Billy Goldfedder, Raul Angulo, and Douglas Cline) with seven received responses to the questionnaire sent to the original ten (70%). In addition to those seven responses, an e-mail from two of the original ten who were not able to respond to the survey indicated that they experienced technical difficulties. The response total from the group of recognized fire service leaders increased then to 90%. Additionally, receipt of unsolicited responses to the recognized leaders’ survey from two respondents, who were forwarded a link to the survey by one of the original recognized fire service leaders, were not counted statistically

but essay responses were read and considered as part of the results. Overall, the collective rate of response totaled over 80% of those solicited.

Results

Responses received from the Texas chief officers' group indicated that a large majority, 89.7%, believe it would be beneficial to have a guideline for strategic decision making at commercial building fires. Only 22.6% indicated their department has established such a guideline. In respect to training, 61.9% indicated their department does conduct training that emphasizes the importance of recognizing critical factors that should indicate the need to establish or change to a defensive strategy at a commercial building fire. A slightly higher 68.2% have read a fire service publication or attended a fire service training class where they felt this topic was adequately addressed. In summary, less than 25% have a guideline and almost 90% believe a guideline for their officers would be beneficial.

Five of seven responders from the GFD chief officers' group, or 71.4%, indicated that the GFD does conduct training on recognizing critical factors that should indicate the need to establish or change to a defensive strategy. The same number indicated that the GFD does not currently have an SOP that specifies definitive criterion for changing from an offensive to a defensive strategy at a commercial building fire, but they believe such an SOP would be beneficial. Of the respondents, 28.6% indicated they do not believe such a guideline would be beneficial.

Over 40% of the recognized fire service leaders indicated their departments have established definitive criterion for initiating or changing to a defensive strategy at a commercial fire. Almost 70% responded that their department conducts training that emphasizes the importance of recognizing critical factors that should indicate the need to establish or change to a

defensive strategy at a commercial building fire. A large majority, 66.7% of fire service leaders reported their departments do not currently have SOPs or SOGs that specify definitive criterion for changing from an offensive to a defensive strategy at a commercial building fire, and 42.9% do not believe such a guideline would be beneficial within their department.

Collectively, 28.1% of the respondents indicated that their department has established an SOP that gives specific criteria for strategic decision making at commercial building fires. Only 66.5% report that the organization conducts training on recognizing critical factors. However, 72.7% believe such a guideline that contains definitive criteria would be beneficial.

Table 1: Summary of questionnaire responses

Respondent Groups	Department has established an SOP that gives specific criteria for strategic decision making	Conduct training on recognizing critical factors that should influence strategic decision making	Believe a guideline that contains definitive criteria would be beneficial
GFD chief officers	28.6%	71.4%	71.4%
Texas chief officers	22.6%	61.9%	89.7%
Fire service leaders	33.3%	66.7%	57.1%
Average	28.1%	66.5%	72.7%

In addition to the forced choice questions explained above, respondents were also asked to provide answers to open-ended questions. In response to the question: have you read any fire service publications or attended any fire service training classes where this topic was adequately discussed or addressed, the majority, 53.7% answered no. The remaining 46.3% indicated yes, most often specifying the topics of those publications or classes as reading smoke and building construction.

Respondents were also encouraged to forward a copy of their department's SOP on commercial building fire responses. Three departments, McKinney and Red Oak, Texas, and Richmond Metro (Hanover), Virginia, forwarded a copy of their current SOP for these types of

structures. Only the ones from Hanover, (Appendix I) and Red Oak, (Appendix J) contained specific criteria for strategic decision making.

The SOP from Red Oak was least descriptive of the two and contained only broad categories that the IC should evaluate as part of a standard risk management model when deciding on an offensive versus defensive strategy. Red Oak's SOP identified fire extent, structural conditions, ventilation profile, resource profile, entry capability and rescue profile as items to be considered by the IC (Red Oak Fire Department, 2006).

The SOP from Hanover was much more specific. In the section titled *Firefighter Safety* numerous hazards and specific operational, tactical and construction related criteria are identified. The Hanover SOP identifies numerous construction characteristics, such as drop ceilings and voids, which can conceal fire, as well as buildings constructed of tilt-slabs and non-compartmentalized buildings, as being especially hazardous to firefighters. Hanover's SOP also specifies numerous tactical considerations that should be deliberated. These items include, but are not limited to, being cautious of an apparent exterior fire, requiring that all personnel inside such a building remain in constant contact with a hose line or limiting the distance crews should penetrate inside such a structure to not more than 150 feet past the entrance point. The SOP further requires attack crews to always enter from the closest entrance to the fire area. The SOP goes on to specify the amount of working time each firefighter has based on the pressure of the self-contained breathing apparatus the firefighter wears, 12 minutes for low-pressure and 20 minutes for high-pressure. The three definitive criteria, within the Hanover SOP (Appendix I), which give the IC the greatest guidance on when to consider changing to a defensive operation, are:

- If moderate to heavy smoke is showing at the ceiling, and hose line crews have not reached the seat of the fire – Evacuate the building and initiate a DEFENSIVE operation. This smoke is fuel, and can quickly ignite. We cannot generate sufficient gpm from hose lines to overcome fuel burning in the ceiling area over the entire length of a big box building.
- If heat and smoke conditions are getting worse during an offensive attack, consider evacuating the building and initiating a DEFENSIVE operation. Keep in mind the lead time it takes to put heavy fire streams in operation
- If fire involves the open truss space of light weight construction do not allow personnel on the roof, and – Evacuate the building and initiate a DEFENSIVE operation. The building can quickly lose roof stability as the roof structure warps, elongates, and gives way. This can result in early collapse of the roof (Richmond Metro Fire Departments, 2008).

Lastly, respondents were asked, what definitive criterion do you believe would be important to include in an SOP on strategic decision making. The responses to this question were downloaded from the on-line survey system in an Excel format. Next, all of the responses were edited and compiled into a list of the most common suggestions. This list was combined with information discovered in the literature review, as well as information gained from reviewing other fire department's SOPs, and are the basis for the product of this action research project (Appendix K). This document represents what the researcher believes to be the first and most comprehensive list of specific definitive criteria to be used by company officers or ICs when making strategic decisions at commercial building fires.

Discussion

Unfortunately, there was found no parallel study against which to contrast the results of this research. This is both concerning and inspiring. Concerning in that the researcher is left to wonder whether or not the topic was properly framed for such a study. Inspiring, in the fact that, if indeed this is a new area of study, or at least a fresh perspective on an existing one, the researcher has the unique, yet precarious, opportunity to set forth, with proper explanation, a list of definitive criteria for implementation within the GFD (Appendix K).

The results of the research demonstrates that there does exist, in a strong majority of those individuals from which responses were solicited, a perceived need for the development of specific definitive criteria for strategic decision making at commercial building fires. Further, based on the results of the research, more than half of the respondents indicated their department conducts training on such critical factors that should influence strategic decision making. However, based on the shortage of information discovered in the literature review and the lack of consistency of the existing information, one is left to wonder what criteria are being taught.

Another issue supported by the research results is that a large majority of the respondents support the idea that a guideline for making such decisions would be beneficial. This was also the consensus of the majority of GFD respondents. These results strongly, even though not unanimously, support the researcher's desire to create and implement an SOP for strategic decision making at commercial building fires. Further, the creation of such a document would necessitate training, during which, further discussion and refinement of the list of critical factors could take place.

Recommendations

This applied research project has shown that there exists within the Garland Fire Department, and furthermore the U.S. fire service, a critical lack of information on strategic decision making at commercial building fires. The most obvious void, relating to this issue, is the absence of a standardized list of critical factors for company officers and Incident Commanders to consider when determining whether to employ an offensive or defensive strategy. An additional issue that was discovered is the lack of a consistent definition of the word strategy. Despite a considerably lower occurrence of fires in commercial versus residential buildings, firefighters are almost twice as likely to be killed at an incident involving a commercial building, (Fahy, LeBlanc, & Molis, 2008). Based on the statistical information alone, it is clear that we must examine and modify our current approach to commercial building fire incidents. To this end, the following recommendations are set forth.

First, the GFD must amend the current SOP (Appendix A), on commercial and industrial building fires to include the critical factors identified in this ARP. The purpose of this recommendation is to set forth, as a component of the written tactical guidelines, a list of specific definitive criteria for company officers and ICs to consider when they encounter a working incident involving a commercial building.

The second recommendation is for the GFD to conduct training, both classroom and live fire, where officers and firefighters can be trained on the new SOP and its application. The purpose of such training is two-fold. First, the training will fill the void identified by over 28% of GFD chief officers (Appendix G), who believe this topic has not been adequately addressed within the organization. Secondly, it will give all GFD officers and firefighters the opportunity to

learn and demonstrate the ability to identify and properly interpret these critical factors when making strategic decisions at these types of incidents.

The third recommendation is that the GFD conduct an evaluation of the remaining tactical SOPs and update them as necessary. These SOPs will include, but are not limited to, single-family, multi-family and high-rise. The purpose of this evaluation will be to determine whether or not the SOPs are current and consistent with the modified commercial and industrial building SOP. This evaluation process will also be an excellent training opportunity for junior officers within the department.

An additional recommendation is that the findings of this ARP be shared with neighboring departments and others within the fire service that might benefit from this research. As demonstrated by their responses (Appendix F), only 22.6 % of other career fire departments within the State of Texas currently have an SOP such as this, while almost 90% believe it would be beneficial. It is further recommended that even those departments who claim to have such an SOP conduct an evaluation of their existing document to verify the presence of specific definitive criteria for strategic decision making at incidents involving commercial structures. Even if it was modified to better suit their organization, most departments believe they would benefit from this information.

Two related topics were discovered during this process that warrant future research. The first one involves the origins and application of fire flow formulas. Although briefly discussed within this ARP, a more detailed examination might reveal that the formulas are outdated or do not fully take into account today's construction practices and the chemical composition of materials and furnishings. The second topic would be to determine if, statistically, one type of

building or method of construction can be identified as more dangerous to firefighters than others.

The creation of this list of critical factors, the modification of the existing SOP, and training on both will improve fireground safety within the GFD. It is the desire of the researcher that this information have a positive and lasting effect not only on firefighter safety within the Garland Fire Department but others within the fire service as well.

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Appendix A

GARLAND FIRE DEPARTMENT

OPERATIONS SOP

ISSUED: 01/30/95

EFFECTIVE: 07/07/99

206

REVISED: 09/04/2004

**PROCEDURES FOR COMMERCIAL
AND
INDUSTRIAL BUILDINGS**

206.1 Purpose

To establish fire fighting procedures for various conditions at Commercial and Industrial Buildings.

206.2 Light Smoke Showing

If first arriving units size up indicates conditions in which light smoke is showing;

A. Initiate Incident Command

- 1) Announce size up - "Light Smoke Showing".
- 2) Announce that command will be mobile and investigating.
- 3) Direct incoming units to stage at nearest hydrant or make assignments to units.

B. Command should investigate, determining source of smoke.

C. Proper size hose line should be advanced to entry, charged and ready for fire attack if needed.

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OPERATIONS SOP
Procedures for Commercial
and Industrial Buildings
Effective Date: 07/07/99
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- D. If command determines that incident can be handled with available resources, command should advise staged units to report to fire scene or to disregard.
- E. Perform proper ventilation to clear building of smoke.
- F. Call Investigator if needed.
- G. Perform overhaul to make property safe.
- H. Perform salvage if needed.

206.3 Heavy Smoke Showing or Fire Showing From One Area

If first arriving units size up indicate conditions in which heavy smoke is showing or fire is showing from one area;

- A Initiate incident command
 - 1) Announce size up - "Heavy Smoke Showing or Fire Showing."
 - 2) Announce action that command determines will be taken.
 - 3) Announce incoming units assignments - if first unit has not laid supply line, second unit should be directed to lay supply line.
- B. Command shall determine if rescue is required- if it is determined that occupants are in structure, try to determine their location, rescue should be given highest priority and coordinated with fire attack and ventilation.
 - 1) First consideration of rescue should be area of fire origin.
 - 2) Assist in evacuation of building.
 - 3) Command shall place lines to safeguard avenues of travel for occupants, if means of egress can not be protected by hand lines, ladders should be set or aerial equipment put in service to assist in rescue of occupants.

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- C. Command shall determine if second priority shall be exposure protection and/or confinement.
 - 1) If command determines that exposure protection and/or confinement are the priority; first unit shall pull proper size lines or activate master streams to protect each side of fire area, above fire area, or any other avenues of fire travel.
 - 2) If command determines that the sprinkler system has activated, command shall assign an engine company to lay a supply line into the Fire Department sprinkler connection and begin pumping at 150 PSI pressure.
 - 3) If structure has a fire pump attached to the system, command shall assign a sector officer to confirm that the fire pump is operational. If fire pump has activated, command shall assign an engine company to lay a supply line into the Fire Department sprinkler connection and begin pumping at 150 PSI pressure.
- D. If command determines that an interior attack is second priority;
 - 1) First unit shall pull proper size line and make an aggressive interior attack, if possible attack fire from unburned area to prevent extension and limit damage.
 - 2) Interior attack shall be coordinated with proper ventilation.
- E. Command shall have a back-up line charged and personnel assigned to it as soon as possible. If back-up line is used to assist initial attack or protect exposures, another back- up line shall be charged and personnel assigned to it.
- F. Command shall determine if situation can be handled with available resources, or if personnel will need to be relieved - if it is determined that assistance will be needed, command shall call for additional units or additional alarms.
- G. Call Investigator.

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- H. Truck companies shall perform salvage operations as soon as possible to protect property and limit damage.
 - 1) Cover contents with salvage covers.
 - 2) Place floor runners.
 - 3) Remove contents to safe areas as time and availability of personnel permit.
- I. Perform overhaul operations
 - 1) Check all avenues of fire spread, exposing wall and ceiling to unburned area.
 - 2) Remove burned contents to safe areas for complete extinguishment.
 - 3) Preserve evidence of fire cause.
- J. Command shall consider establishing rehabilitation sector.

206.4 Heavily Involved

If first arriving units size-up indicates conditions in which a commercial or industrial structure is heavily involved and command determines that there will be an offensive attack, the same strategy and tactics shall apply that are used on commercial or industrial structure with heavy smoke or fire showing.

If first arriving units size-up indicates conditions in which a commercial or industrial building is heavily involved and command determines that strategy dictates a defensive mode:

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- A. Initiate incident command
 - 1) Announce size up - "Heavily Involved".
 - 2) Announce that fire attack will be defensive.
 - 3) Announce incoming unit assignments - if first unit has not laid supply line, second unit should be directed to lay supply line.
- B. Command shall determine if rescue is required or possible-if it is determined that occupants are in structure, try to determine their location, rescue should be given highest priority and coordinated with fire attack and ventilation.
 - 1) First consideration of rescue should be area of fire origin.
 - 2) Assist in evacuation of building.
 - 3) Command shall place hand lines to safeguard avenues of travel for occupants, if means of egress can not be protected by hand lines, master streams should be activated to protect avenues of travel.
 - 4) Ladders should be set or aerial equipment put in service to assist in rescue of occupants on upper floors.
- C. Command shall determine if second priority shall be exposure protection and/or confinement.
 - 1) If command determines that exposure protection and/or confinement are the priority; first unit shall pull proper size lines or activate master streams to protect each side of fire area, above fire area or any avenue of fire travel.
 - 2) If command determines that sprinkler system has activated or fire pump is operational command shall assign an engine company to lay a supply line into the fire department sprinkler connection and begin pumping at 150 PSI pressure.

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- D. Use proper size hand lines or master streams to extinguish fire.
 - 1) If master streams are used, personnel should not be assigned to interior attack.
 - 2) If aerial master streams are used, equipment should be placed in position to have full range of motion for maneuverability and far enough from structure to insure safety in the event of building collapse.
 - 3) If monitors are used, they should be positioned to make them as mobile as possible and far enough from structure to insure safety in the event of building collapse.
 - 4) When fire has been controlled master streams shall be shut down as soon as practical so that hand lines may be advanced to complete extinguishment.
- E. Command shall have back-up lines charged and personnel assigned to them as soon as possible, if back-up lines are used additional back-up lines shall be pulled and personnel assigned to them.
- F. Command shall determine if situation can be handled with available resources, or if personnel will have to be relieved - if it is determined that assistance will be needed, command shall call additional units or additional alarms.
- G. Command shall establish rehabilitation sector.
- H. Call Investigator.
- I. Truck companies shall perform salvage operations as soon as possible to protect property and limit damage.
 - 1) Cover contents with salvage covers.
 - 2) Place floor runners.
 - 3) Remove contents to safe areas as time and availability of personnel permit.

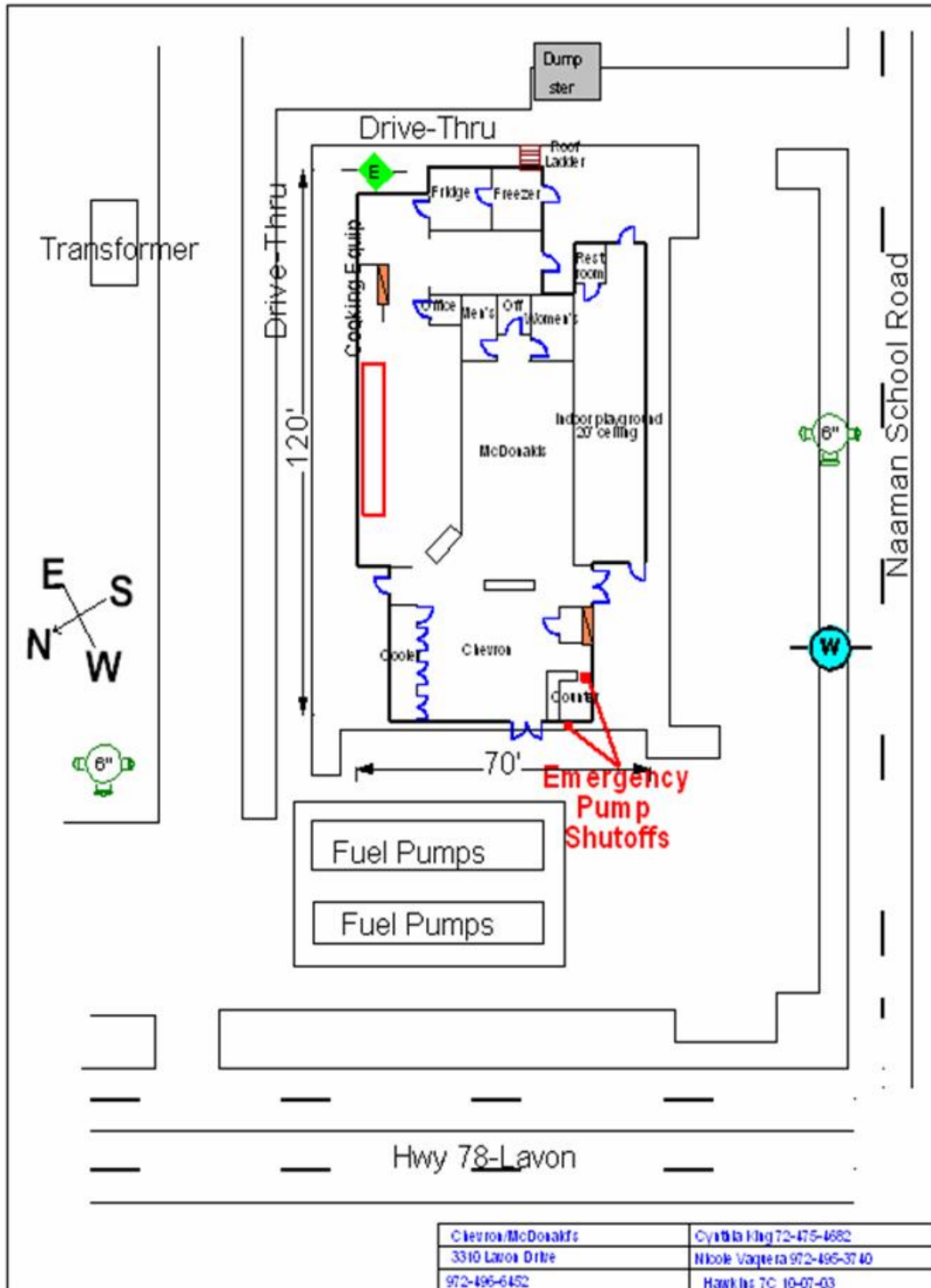
**GARLAND FIRE DEPARTMENT
OPERATIONS SOP
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and Industrial Buildings
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- J. Perform overhaul operations.
 - 1) Check all avenues of fire spread, exposing wall and ceiling to unburned area.
 - 2) Remove burned contents to safe areas for complete extinguishment.
 - 3) Preserve evidence of fire cause.

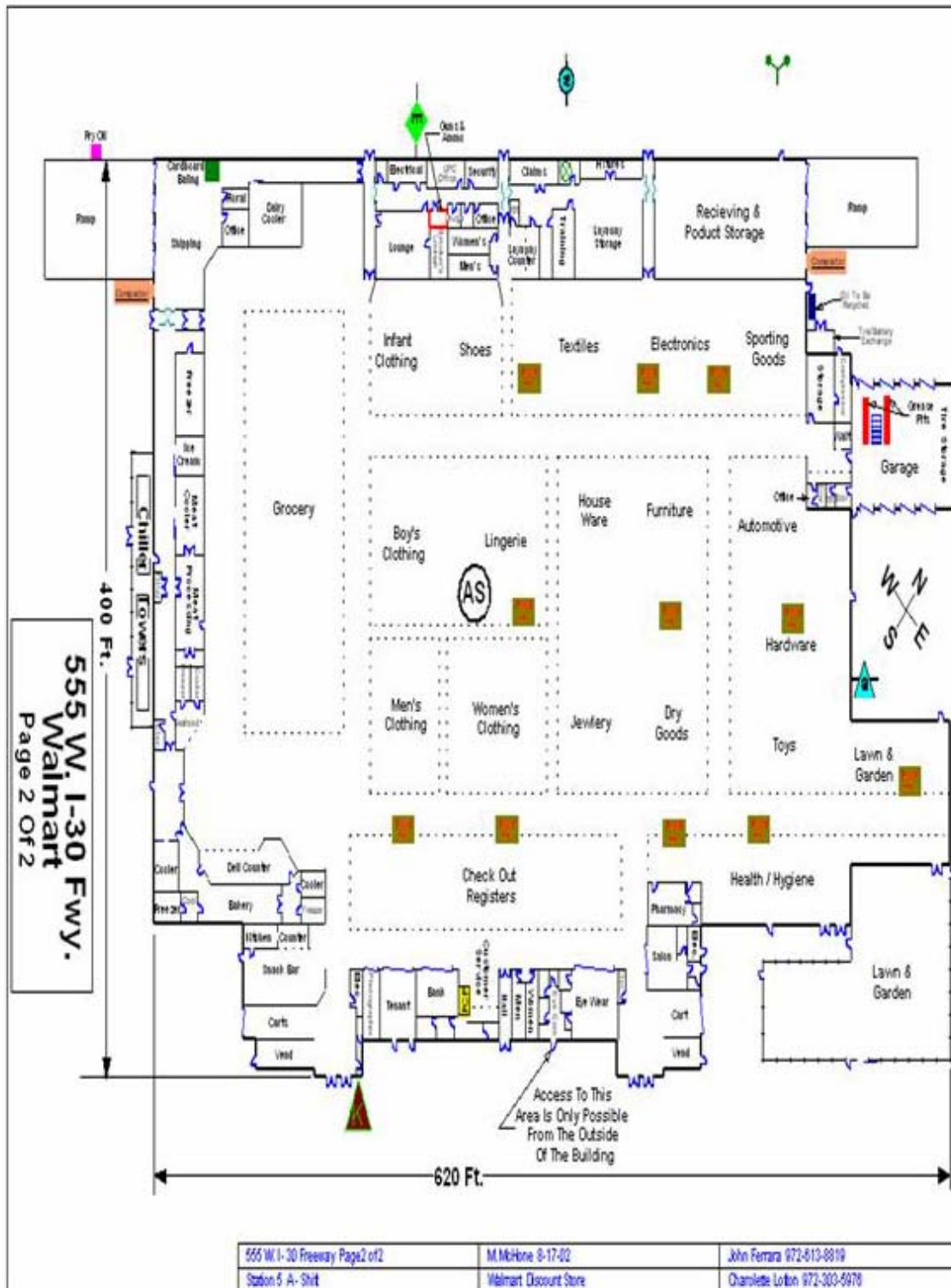
206.5 Rapid Intervention Company shall be on scene and mobilized as per Garland Fire Dept. SOP #229 at discretion of Incident Commander.

Jack James
Chief of Operations

Appendix B
Garland Fire Department
Pre-fire plan of McDonald's Restaurant



Appendix C
Garland Fire Department
Pre-fire plan of Walmart Store



Appendix D
Questionnaire used as created on Survey Monkey.com

1. The following information will be used for demographic information only. Your answers are greatly appreciated.

Department:

City/Town:

State:

Email Address:

2. What population does your department serve?

10,000 or less

10,001 – 50,000

50,001 – 100,000

100,001 – 500,000

Over 500,000

3. Is your department:

1-10

11-50

51-100

101-250

More than 250

Career

Volunteer

Combination

4. Has your department established any definitive criterion for initiating and/or changing to a defensive strategy at commercial building fires?

a. If yes, please elaborate:

5. Does your department conduct training that emphasizes the importance of recognizing critical factors that should indicate the need to establish or change to a defensive strategy at commercial building fires?

a. If yes. please elaborate:

6. Does your department have SOPs/Directives/SOGs that prescribe procedures for Fire Department operations at various types of emergency events i.e. high-rise fires, gas leaks, mass casualty incidents etc?

7. Does your department currently have SOPs/Directives/SOGs that specify definitive criterion for changing from an offensive to defensive strategy at commercial building fires?

a. If yes, please forward a copy to lstephen@ci.garland.tx.us

8. If no to #7, do you believe it would be beneficial to have such a guideline? Yes / No

9. Have you read any fire service publications or attended any fire service training class where this topic was adequately discussed/addressed?
Yes/No
If yes, what were some of the points you remember?
10. If you were to create such an SOP/Directive/SOG what definitive criterion do you believe would be important to include?

Appendix E
E-mail to questionnaire recipients

Greetings all, as you may be aware, I am in the first year of the NFA's EFO program and I am diligently working on my first Applied Research Paper. My topic is Strategic Decision Making at Commercial Building Fires. Would you please take a couple of minutes to complete a short survey to assist me with my research? The questionnaire can be found at the following link:

http://www.surveymonkey.com/s.aspx?sm=wWh1jbkwtm9CwXQwW4bqSA_3d_3d


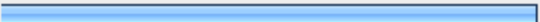


If you have any additional information that you believe might be helpful feel free to contact me or forward the information to me at lstephen@ci.garland.tx.us


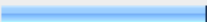




Thank you for your time and input.

Les Stephens
Garland Fire Department
817-929-1108



Appendix F
Questionnaire responses from career fire departments within the State of Texas



Strategic Decision Making at Commercial Building Fires



1. The following information will be used for demographic purposes only. Your answers are greatly appreciated.		
	Response Percent	Response Count
Department: 	100.0%	85
City/Town: 	98.8%	84
State: 	97.6%	83
Email Address: 	94.1%	80
<i>answered question</i>		85
<i>skipped question</i>		0

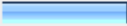

2. What population does your department serve?		
	Response Percent	Response Count
10,000 or less 	7.1%	6
10,001 to 50,000 	37.6%	32
50,001 to 100,000 	17.6%	15
100,001 to 250,000 	24.7%	21
250,001 to 500,000 	5.9%	5
over 500,000 	7.1%	6
<i>answered question</i>		85
<i>skipped question</i>		0



3. How many employees does your department/organization have?						
	1-10	11-50	51-100	101-250	More than 250	Response Count
Career	3.8% (3)	27.8% (22)	22.8% (18)	29.1% (23)	16.5% (13)	79
Volunteer	37.5% (3)	62.5% (5)	0.0% (0)	0.0% (0)	0.0% (0)	8
Combination	0.0% (0)	100.0% (8)	0.0% (0)	0.0% (0)	0.0% (0)	8
<i>answered question</i>						85
<i>skipped question</i>						0



4. Has your department established any definitive criterion for initiating or changing to a defensive strategy at commercial building fires?			Response Percent	Response Count
Yes			30.6%	26
No			69.4%	59
If yes, please elaborate.				27
<i>answered question</i>				85
<i>skipped question</i>				0

5. Does your department conduct training that emphasizes the importance of recognizing critical factors that should indicate the need to establish or change to a defensive strategy at commercial building fires?			Response Percent	Response Count
Yes			61.9%	52
No			38.1%	32
If yes, please elaborate.				53
<i>answered question</i>				84
<i>skipped question</i>				1

6. Does your department have SOPs/Directives/SOGs that prescribe procedures for fire department operations at various types of emergency events i.e. high-rise fires, gas-leaks, mass-casualty incidents, etc.?		
	Response Percent	Response Count
Yes 	91.7%	77
No 	8.3%	7
<i>answered question</i>		84
<i>skipped question</i>		1

7. Does your department currently have SOPs/Directives/SOGs that specify definitive criterion for changing from an offensive to defensive strategy at commercial building fires?		
	Response Percent	Response Count
Yes. If so please forward a copy of the SOP/Directive/SOG to Istephen@ci.garland.tx.us 	22.6%	19
No 	77.4%	65
<i>answered question</i>		84
<i>skipped question</i>		1

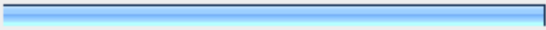
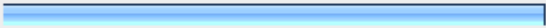
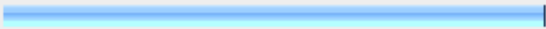
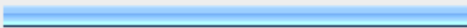
8. If no to #7 above, do you believe it would be beneficial to have such a guideline within your department?		
	Response Percent	Response Count
Yes 	89.7%	61
No 	10.3%	7
<i>answered question</i>		68
<i>skipped question</i>		17

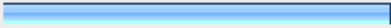

9. Have you read any fire service publications or attended any fire service training class where this topic was adequately discussed/addressed?		
	Response Percent	Response Count
Yes 	31.8%	27
No 	68.2%	58
If yes, what are some of the ideas, points or criterion that you remember from the class?		25
<i>answered question</i>		85
<i>skipped question</i>		0

10. If you were to create an SOP/Directive/SOG on establishing or changing to a defensive strategy at commercial building fires, what definitive criterion do you believe would be important to include?	
	Response Count
	70
<i>answered question</i>	70
<i>skipped question</i>	15



Appendix G
Questionnaire responses from chief officers of the Garland Fire Department


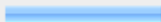
Copy of Strategic Decision Making at Commercial Building Fires 2


1. The following information will be used for demographic purposes only. Your answers are greatly appreciated.		
	Response Percent	Response Count
Department: 	100.0%	7
City/Town: 	100.0%	7
State: 	100.0%	7
Email Address: 	85.7%	6
<i>answered question</i>		7
<i>skipped question</i>		0

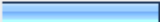

2. What population does your department serve?		
	Response Percent	Response Count
10,000 or less	0.0%	0
10,001 to 50,000	0.0%	0
50,001 to 100,000	0.0%	0
100,001 to 250,000 	71.4%	5
250,001 to 500,000 	28.6%	2
over 500,000	0.0%	0
<i>answered question</i>		7
<i>skipped question</i>		0



3. How many employees does your department/organization have?						
	1-10	11-50	51-100	101-250	More than 250	Response Count
Career	0.0% (0)	0.0% (0)	0.0% (0)	14.3% (1)	85.7% (6)	7
Volunteer	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0
Combination	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0
<i>answered question</i>						7
<i>skipped question</i>						0



4. Has your department established any definitive criterion for initiating or changing to a defensive strategy at commercial building fires?			Response Percent	Response Count
Yes			57.1%	4
No			42.9%	3
If yes, please elaborate.				4
<i>answered question</i>				7
<i>skipped question</i>				0

5. Does your department conduct training that emphasizes the importance of recognizing critical factors that should indicate the need to establish or change to a defensive strategy at commercial building fires?			Response Percent	Response Count
Yes			71.4%	5
No			28.6%	2
If yes, please elaborate.				5
<i>answered question</i>				7
<i>skipped question</i>				0

6. Does your department have SOPs/Directives/SOGs that prescribe procedures for fire department operations at various types of emergency events i.e. high-rise fires, gas-leaks, mass-casualty incidents, etc.?			
		Response Percent	Response Count
Yes		100.0%	7
No		0.0%	0
answered question			7
skipped question			0

7. Does your department currently have SOPs/Directives/SOGs that specify definitive criterion for changing from an offensive to defensive strategy at commercial building fires?			
		Response Percent	Response Count
Yes. If so please forward a copy of the SOP/Directive/SOG to lstephen@ci.garland.tx.us		28.6%	2
No		71.4%	5
answered question			7
skipped question			0

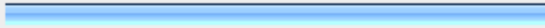
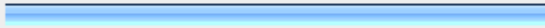
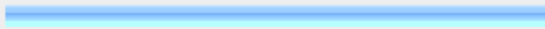

8. If no to #7 above, do you believe it would be beneficial to have such a guideline within your department?			
		Response Percent	Response Count
Yes		71.4%	5
No		28.6%	2
answered question			7
skipped question			0

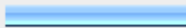



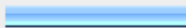
9. Have you read any fire service publications or attended any fire service training class where this topic was adequately discussed/addressed?		
	Response Percent	Response Count
Yes 	57.1%	4
No 	42.9%	3
If yes, what are some of the ideas, points or criterion that you remember from the class?		4
<i>answered question</i>		7
<i>skipped question</i>		0

10. If you were to create an SOP/Directive/SOG on establishing or changing to a defensive strategy at commercial building fires, what definitive criterion do you believe would be important to include?	
	Response Count
	6
<i>answered question</i>	6
<i>skipped question</i>	1



Appendix H
Questionnaire responses from recognized fire service
leaders


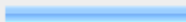
Strategic Decision Making at Commercial Building Fires 3



1. The following information will be used for demographic purposes only. Your answers are greatly appreciated.		
	Response Percent	Response Count
Department: 	100.0%	9
City/Town: 	100.0%	9
State: 	100.0%	9
Email Address: 	100.0%	9
<i>answered question</i>		9
<i>skipped question</i>		0



2. What population does your department serve?		
	Response Percent	Response Count
10,000 or less	0.0%	0
10,001 to 50,000 	33.3%	3
50,001 to 100,000 	11.1%	1
100,001 to 250,000 	11.1%	1
250,001 to 500,000 	11.1%	1
over 500,000 	33.3%	3
<i>answered question</i>		9
<i>skipped question</i>		0



3. How many employees does your department/organization have?						
	1-10	11-50	51-100	101-250	More than 250	Response Count
Career	12.5% (1)	12.5% (1)	0.0% (0)	25.0% (2)	50.0% (4)	8
Volunteer	33.3% (1)	33.3% (1)	0.0% (0)	0.0% (0)	33.3% (1)	3
Combination	0.0% (0)	0.0% (0)	100.0% (1)	0.0% (0)	0.0% (0)	1
<i>answered question</i>						9
<i>skipped question</i>						0



4. Has your department established any definitive criterion for initiating or changing to a defensive strategy at commercial building fires?			
		Response Percent	Response Count
Yes		44.4%	4
No		55.6%	5
If yes, please elaborate.			5
<i>answered question</i>			9
<i>skipped question</i>			0

5. Does your department conduct training that emphasizes the importance of recognizing critical factors that should indicate the need to establish or change to a defensive strategy at commercial building fires?			
		Response Percent	Response Count
Yes		66.7%	6
No		33.3%	3
If yes, please elaborate.			6
<i>answered question</i>			9
<i>skipped question</i>			0

6. Does your department have SOPs/Directives/SOGs that prescribe procedures for fire department operations at various types of emergency events i.e. high-rise fires, gas-leaks, mass-casualty incidents, etc.?			
		Response Percent	Response Count
Yes		88.9%	8
No		11.1%	1
answered question			9
skipped question			0

7. Does your department currently have SOPs/Directives/SOGs that specify definitive criterion for changing from an offensive to defensive strategy at commercial building fires?			
		Response Percent	Response Count
Yes. If so please forward a copy of the SOP/Directive/SOG to Istephen@ci.garland.tx.us		33.3%	3
No		66.7%	6
answered question			9
skipped question			0

8. If no to #7 above, do you believe it would be beneficial to have such a guideline within your department?			
		Response Percent	Response Count
Yes		57.1%	4
No		42.9%	3
answered question			7
skipped question			2

9. Have you read any fire service publications or attended any fire service training class where this topic was adequately discussed/addressed?		
	Response Percent	Response Count
Yes 	50.0%	4
No 	50.0%	4
If yes, what are some of the ideas, points or criterion that you remember from the class?		5
<i>answered question</i>		8
<i>skipped question</i>		1

10. If you were to create an SOP/Directive/SOG on establishing or changing to a defensive strategy at commercial building fires, what definitive criterion do you believe would be important to include?	
	Response Count
	7
<i>answered question</i>	7
<i>skipped question</i>	2

Appendix I



Richmond Metro Big Box Fire Standard Operational Guideline

August 2008

Introduction:

In our country recent fires in "Big Box" structures have proven to be deadly to firefighters. Richmond Metro firefighters are experienced in fighting fires in single family dwellings (SFDs). Richmond Metro firefighters have limited experience fighting fires in "Big Box" structures. Findings from several incidents demonstrate that approaching a "Big Box" fire with SFD strategy and tactics can be deadly to firefighters. Hundreds of these types of buildings exist in the Richmond Metro area, and more are being built every day. Therefore, Richmond Metro firefighters will fight fires in these buildings.

Purpose:

The purpose of this guideline is to layout the safe method to approach a fire in one of these buildings. This guideline has been agreed on by the four Richmond Metro fire departments of Richmond City, Hanover County, Henrico County and Chesterfield County. As mutual aid is likely to be utilized with significant fires in these buildings, it is important for all personnel operating in these departments to share expectations of how these fires and resulting firefighter hazards will be managed.

Definition:

A big box is a large building with non-compartmented space(s) routinely 40,000 square feet or larger in area. Most are a rectangular shaped building with a single floor built on a concrete slab. While the majority of area is one floor, many of these include second floor offices or stock rooms in the front or rear of the building. Some are stand-alone buildings while others share one or both side walls with other occupancies. Most have a flat roof and ceiling trusses made of steel. However some older buildings may have a wooden truss roof assembly. The walls are concrete block sometimes clad in metal or masonry siding.

Strategic guidelines:

The following strategies have been identified as critical to the safe handling of a fire in a “Big Box” structure. These strategies are to be considered in this order. Tactical considerations to achieve each strategy are detailed in the next section of this guideline:

1. Exterior / Interior size up assessment
2. Supplement fire suppression systems
3. Assess life safety, and Evacuation
4. Determine fire location
5. Extension considerations / prevention
6. Confinement and extinguishment of fire
7. Ventilation

Tactical Considerations

1. Size Up:

- **Pre-Arrival**

Consider the mode of alarm initiation. Dispatch information as to automatic detection or water flow versus a call from inside reporting visible smoke or fire may prove beneficial. While certainly not always accurate or reliable, this information may offer some early indication as to the potential phase and level of involvement of the fire.

- **Exterior**

Every attempt should be made to complete a full 360-degree observation of the structure as initial size up. This step is crucial to limiting unnecessary exposure of crews.

Note the intensity and action of smoke. Smoke rising from an active fire versus cold smoke from a fire largely controlled by the automatic sprinkler **SHOULD** be an indicator of whether an entry is feasible or appropriate. Evident smoke or fire conditions indicating involvement of any truss roof system, particularly bowstring truss, **SHOULD** indicate an exterior attack.

The general tactic of “attack from the unburned side” typically deployed in the confined and compartmented spaces of the residential setting, is of little merit in the Big Box scenario. Entry for hose line deployment, if appropriate, should be made at the point offering the most direct access to the fire. This simple tactic will greatly decrease

exposure to crews and help ensure a safer and less hindered escape.

An appropriate view of the structure may be completed using any or all of the following methods:

Drive Around: The simple size of the building or placement within the complex may hinder the normal walking lap typically made by the first-in Incident Commander (IC). Driving around the building before committing apparatus placement may reveal useful information such as sprinkler system activation or the exact location of the fire itself.

Incoming Resource Recon: Utilizing incoming companies to complete the exploration lap while IC is conducting typical side “Alpha” size-up may be more practical and reveal hazards not seen from the front or normal approach.

Thermal Imagery: Use of thermal imagery from the exterior may indicate “hot spots” on walls or overhead doors, indicating possible proximity of the seat of the fire.

Elevated Observation: Perhaps not the most practical tool for initial size-up. Size-up however should be an ongoing practice and continued throughout the operation. The “bird’s eye” view of the aerial company may be invaluable to this effort.

- **Interior**

Interior assessment should be made from exterior vantage points whenever possible before entry. Plate glass storefronts, loading dock doors, and multiple pedestrian entry doors offer potential points to observe interior conditions and determine if interior attack is possible or appropriate. Limit unnecessary interior penetration by utilization of these observation points as potential fire attack points.

Entry into IDLH environments with poor visibility and no reliable indication of fire location present unacceptable risks to entry crews. Entry into these types of environments to search for the fire **SHOULD** be considered inappropriate.

If conditions and information indicate interior entry is appropriate, crews must use caution to maintain their position between the fire and their escape route. The potential for hidden fires must be considered and addressed as entry is made and throughout the interior operation. All areas of potential hazard, such as fire spread in concealed spaces, drop ceilings and voids, must be explored as they are encountered to ensure fire does not present itself behind the crews. Any indication of involvement in the structural area of the roof of these types of structures **SHOULD** be considered as immediate justification to abandon interior operations and explore alternate access to the fire.

2. Supplement of Fire Suppression System

- **Sprinkler System**

Supplemental support of the fire suppression system is essential for fire control and extinguishments. Supplemental support of the fire suppression system is among the most effective methods limiting crew exposure to interior operations, while simultaneously addressing occupant life safety. Care must be taken to ensure the proper system is

actually supplied when multiple systems or split systems exists in the occupancy. Reference to updated pre-plans will assist with this effort.

- **Standpipe**

Standpipe utilization should be considered effective only for small incipient fire suppression or later overhaul operations. The most prominent limiting factor affecting utilization of these systems for larger scale suppression operations is the inconsistent or unknown locations. Even when locations may be well documented during pre-planning activities, the typical mid-aisle or end-of aisle placement may prove difficult to locate under dense smoke conditions. Dependence on these systems presents further risk to fire crews entering without the protection of a charged hose line.

Other negative factors include potentially limited flow capacity and non-standard attachment sizes.

3. **Life Safety / Evacuation:**

Citizen Safety: Life safety is the highest incident priority during a big box fire response. Upon arrival, companies may encounter evacuation of citizens in progress. This effort should be continued in order to ensure all citizens exit the building safely.

- Due to the inability to quickly remove smoke from these buildings, and the amount of time it will take to completely search a big box, a focused area search is the most reasonable rescue attempt. If citizens are reported to be missing or trapped, the best chance of a successful rescue is to identify as close as possible where they are. It is necessary to acquire clear, accurate and concise information of the following:
 - Number of citizens missing or trapped
 - Known location geographically in the big box
 - Location of fire and/or fire conditions in relation to those trapped
 - Are occupants in distress or trapped
 - Any method to communicate with those trapped
- The incident commander should consider a substantial direct fire attack with coordinated ventilation as the best method of protecting trapped citizens. If an interior attack is to be mounted, it needs to be very well coordinated with ventilation efforts and be established with large caliber fire streams.

Firefighter Safety: We must consider the potential of rapid fire and smoke spread in these non-compartmentalized buildings. Drop ceilings and other voids can easily hide fire, and heavy fuel loads add to the danger. Due to the hazards that these buildings present, specific tactical operations need to be employed to ensure the safety of firefighters:

- Beware the “exterior” fire. Assume that any exterior fire has penetrated the interior. Conduct any “recon” as if you are entering a known fire situation.
- An appropriate sized and equipped R.I.C. must be established prior to interior operations. This resource SHOULD be established for each crew entry point.

- All interior personnel **MUST** remain on a hose line (as a last resort, a rescue tag line can be utilized for crews conducting a focused rescue attempt). Be wary of the incident with light smoke inside a big box. Conditions can change suddenly bringing the area to zero visibility. Staying in contact with the hose line / tag line may be the only method to prevent disorientation and allow personnel to exit the building.
- Due to the inherent dangers of penetrating long distances inside a big box on fire, interior hose stretches should be limited to 150 feet past the entrance point. Attack crews should enter the closest entrance to the fire area.
- Air management is of paramount importance for interior crews. Crews with low pressure SCBA (Henrico and Chesterfield) are each to work for only 12 min. of on-air time and then turn around to exit the building. Crews with 45 min. high pressure SCBA (Richmond and Hanover) will turn around at 20 min. or 2000 psi left in a crew member's bottle. If any crew member reaches 50% of air capacity the crew will exit the building.
- If moderate to heavy smoke is showing at the ceiling, and hose line crews have not reached the seat of the fire – Evacuate the building and initiate a **DEFENSIVE** operation. This smoke is fuel, and can quickly ignite. We can not generate sufficient gpm from hose lines to overcome fuel burning in the ceiling area over the entire length of a big box building.
- If heat and smoke conditions are getting worse during an offensive attack, consider evacuating the building and initiating a **DEFENSIVE** operation. Keep in mind the lead time it takes to put heavy fire streams in operation
- If fire involves the open truss space of light weight construction do not allow personnel on the roof, and – Evacuate the building and initiate a **DEFENSIVE** operation. The building can quickly lose roof stability as the roof structure warps, elongates, and gives way. This can result in early collapse of the roof.
 - Beware, a big box with tilt-slab constructed wall. These walls can fall outward if the roof loses stability.
 - Personnel and Apparatus should operate outside of the collapse zone

4. Fire Location Determination:

Determine location of the fire as soon as possible. All future tactical operations depend on this vital information. This information can be obtained from citizen accounts, enunciator panel indicators in the fire control room, visual observances upon arrival, and use of a TIC during the 360 degree survey of the building.

If unable to determine the location and magnitude of the fire consider:

- Expanding Ventilation – horizontal and vertical (position attack crews prior to initiating this tactic) Limit roof access with unknown fire location
- Large caliber defensive tactics
- PPV if extensive ventilation efforts fail to expose fire location / magnitude

5. Exposure Protection – Protecting exposures should be addressed at size-up and continuously reevaluated during the entire operation. The primary responsibility of the

first arriving crews should be life safety and exposure protection until sufficient resources are in place to mount an interior attack on the building of origin. Exposure protection could fall into two categories:

- Internal Exposures – Uninvolved parts of the structure separated by firewall. Exposure protection in this instance would consist of closing fire doors, exposure lines operated from a safe area in the uninvolved part of the structure and aggressive ventilation tactics.
- External Exposures – Uninvolved buildings which are not connected to the involved structure. Large diameter streams, interior operations in the exposed building, and roof operations on the exposed building are suitable exposure protection operations.

6. Confinement and Extinguishment – Even small incipient fires in a large square footage facility could spread and escalate to a structure fire quickly. The fuel loads could be significant, therefore proper preplanning and site familiarization is essential. The following guidelines should be followed with regards to fire confinement and extinguishment in “big box” structures:

- Maximum hose line advancement – Due to building size, construction characteristics, air management, and safety considerations the maximum penetration into the structure should be no further than 150 feet.
- Fire attack should be initiated from the closest exterior entry point to the fire – By reading the smoke and witness interviews an educated guess should be made as to the location of the fire. Once the location of the fire is determined, pick the point of entry that is closest to the fire to initiate fire attack. This entry point should be indicated to command to allow proper coordination of other fire ground priorities.
- Utilize large caliber hose lines – Unless credible information indicates that the fire is incipient in nature, a minimum attack line of 2 ½ inches should be utilized for any interior attack in a “big box” structure. Considerations should be made to select a nozzle that will ensure sufficient reach, penetration, and GPM flow for proper extinguishment.

7. Ventilation - Due to construction features and hazards of roof operations, effective ventilation of a significant fire in a big box building is often difficult.

- If significant ventilation efforts are needed in order to make entry, the operation **SHOULD** be defensive.
- If crews are operating inside the building and conditions worsen, vertical ventilation (coordinated with interior operations) **SHOULD** be established quickly. This will help interior crews to escape. This ventilation must be made quickly. Therefore, analysis of the roof and preparation to safely vent it must be conducted early in the operation. Opening skylights and operating from aerial apparatus will often be necessary for the safety of ventilation crews.
- Horizontal ventilation **SHOULD NOT** be conducted while interior operations are in progress.

Summary:

As a result of numerous “Line of Duty Deaths”, and injuries, a guideline that directly addresses “Big Box” fires is required. This guideline is intended to focus and direct our efforts to successfully mitigate this type of incident, while providing the maximum level of safety, and accountability to our personnel.

Appendix J

Red Oak Fire Rescue

SECTION: 1800Date: 3/2006**Procedures**

Fire Control

It is standard operating procedure to attempt to stabilize fire conditions by extending **WHEREVER POSSIBLE** an aggressive well-placed and adequate offensive interior fire attack effort and to support that aggressive attack with whatever resource and action is required to reduce fire extension and to bring the fire under control.

A critical Command decision (both initial and on going) relates to the offensive/defensive strategy of the situation:

Offensive Strategy--Interior attack and related support directed toward quickly conducting a search for victims and bringing the fire under control.

Defensive Strategy--Exterior attack directed to first reduce fire extension and then bring the fire under control.

Command must declare which strategy is being used as part of the on-scene report and at each notification of elapsed time.

DURING AN OFFENSIVE ATTACK THERE WILL BE NO DEFENSIVE ATTACK. DURING A DEFENSIVE ATTACK THERE WILL BE NO OFFENSIVE ATTACK. (IE. INTERIOR ATTACK AND DECK GUN OPERATIONS AT THE SAME TIME)

Command must define offensive/defensive strategy based upon a standard risk management profile evaluating:

- Fire extent
- Structural conditions
- Entry capability
- Ventilation profile
- Rescue profile of occupants
- Resources profile

BASIC OFFENSIVE PLAN

- Take Command
- Identify critical fireground factors
- Establish IRIC
- First line--fast, aggressive interior attack
- Provide support activities (i.e., ventilation, forcible entry)
- Do primary search
- Second line--backup first/cover opposite side
- Pump water
- Quickly evaluate success and react

BASIC DEFENSIVE PLAN

- Take Command
- Evaluate fire spread/write-off lost property
- Identify critical fireground factors
- Prioritize fire streams
- Provide big, well placed streams
- Pump water
- Quick determination on additional resource

Surround and drown

Appendix K

Critical factors for strategic decision making at commercial building fires

- Offensive strategy = we are willing to get someone killed for what remains to be saved.
- Defensive strategy = there is nothing left to save that is worth the risk of getting a firefighter killed.
- Is there a life safety issue (savable victims) = offensive strategy.
- What percentage of the building is on fire?
 - Consider the percentage of the building in relationship to the total square footage
 - 10% of a 100,000 square foot building is worse than 25% of a 5,000 square foot building
- Know the Fire Flow Formula: $L \times W = \frac{GPM}{3}$
 - Can you sustain the needed fire flow?
 - Do you have sufficient personnel to direct the large diameter hose streams necessary to achieve the needed fire flow?
 - Is it practical to believe you can achieve the fire flow in the area needed in a short enough period of time to make a difference in the outcome (reflex time)?
 - Is the needed fire flow included on the pre-fire plan?
- Is there adequate personnel on-scene to safely conduct the operation?
 - 2-in/2-out
 - back-up line
 - rapid intervention
 - safety
- Do you know the building's occupancy type, building contents and where the fire is located inside the building?
 - Storage: What is stored in that area of the building? Dog food or dynamite?
 - Industrial process: What process is conducted in that area of the building? General product assembly or metal plating using combustible or hazardous materials?
 - Manufacturing: What are they manufacturing? Cardboard boxes or bombs?
- How long have crews been operating inside the building? If greater than 10 minutes with no appreciable change in conditions = go defensive.
- Is the building dilapidated, abandoned or vacant?
- Fire burning through the roof of a commercial building = go defensive.
- If you have to advance attack hose lines greater than 150 feet inside the building from the closest entrance to the seat of the fire = go defensive.
- If the fire has overrun or is beyond the capability of properly functioning fixed fire protection systems (sprinklers) = go defensive.
- Type of building construction? Different types of construction can offer different time frames before failure or collapse.
 - Fire cut construction versus heavy timber
 - Heavy timber versus steel bar joist
 - Steel bar joist versus light-weight wood truss systems
- Is the light weight truss (wood or metal) involved in fire? If no change in conditions with first attack line in operation = go defensive.
- Communication problems. If we cannot communicate with our personnel = go defensive.

- Read and interpret the smoke conditions. If smoke is visible at the top of the 8 foot door of a commercial building, evaluate the ratio of door height to ceiling height to determine the amount of smoke present (smoke = fuel). For example: McDonald's has a 10-12 foot high ceiling versus Walmart which has a 25-30 foot high ceiling.
- Track the time the fire has been burning, size and intensity of the fire and what effect the fire is having on the building.
- Ask yourself...honestly...is the building already lost?
- Watch for building collapse indicators, cracks, sagging roof, smoke showing through seams in walls, leaning walls = go defensive.
- We have to change the mindset of using residential tactics at commercial building fires.
- Three good questions to ask: why are you in the building, what is the best possible outcome, and does it still make sense for our personnel to be in the building?